Appeal No. 2017-1149

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

IN RE: C. DOUGLASS THOMAS,

Appellant

Appeal from the United States Patent and Trademark Office,
Patent Trial and Appeal Board in Serial No. 13/099,285.

BRIEF FOR DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Representative Claim

4. A method for thermally managing temperature of a computing apparatus having a microprocessor, the microprocessor operating in accordance with a clock having a clock frequency, the microprocessor including an internal temperature sensor, the computing apparatus including circuitry external to the microprocessor for thermal management, the computing apparatus including a fan controllably operable to cool at least a portion of the computing apparatus, the method comprising:

receiving, at the circuitry external to the microprocessor, a temperature measurement of the microprocessor from the internal temperature sensor;

managing the temperature of at least the microprocessor of the computing apparatus based at least in part on the temperature measurement provided at least in part by the temperature sensor;

determining which of at least two operational modes the computing apparatus is operating;

retrieving fan control data dependent on at least the operational mode the computing apparatus is operating;

comparing, at the circuitry external to the microprocessor, the temperature measurement with the fan control data to produce fan speed data; and

controlling speed of the fan based on the fan speed data.

Appx251.

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STATEMENT OF RELATED CASES

The Director is not aware of any other appeal in connection with this proceeding that has previously been before this or any other court, or any other case pending in this or any other court that will directly affect or directly be affected by the Court's decision in this appeal.

However, the Appellant C. Douglass Thomas was previously before this Court in *Thomas v. Pippin*, 2013-1142, *et al.*, 534 F. App'x 992 (Fed. Cir. Oct. 15, 2013) ("*Thomas I*") (affirming without opinion the Board's adverse final decisions in three interference proceedings resulting in the cancellation of all claims involved in seven of Thomas's U.S. patents), *rehearing and rehearing en banc denied without comment*, Fed. Cir. Dec. 23, 2013, *cert denied*, 134 S. Ct. 1916 (2014). Those patents belonged to the same patent family and relied upon the same disclosure involved in *Thomas v. Pippin*, 2015-1575, *et al.*, 628 Fed. App'x 766 (Fed. Cir. Jan. 15, 2016) ("*Thomas II*") (affirming without opinion the Board's adverse final decisions in four more interference proceedings resulting in the cancellation of all claims in two of Thomas's U.S. patents and two of Thomas's U.S. patent applications). The involved Thomas patents and applications are part of a family of related patents and pending continuation applications, each claiming priority back to Thomas's U.S. Patent Application No. 08/262,754, which was filed on June 20, 1994.

Thomas's U.S. Patent Application No. 13/099,285 – at issue in this appeal – relies upon the same disclosure presented in *Thomas I* and *II*, concerns the same basic technology (generally directed to providing thermal and power management for a computing device by controlling a processor's clock speed or fan speed), includes overlapping prior art patents (including a related Pippin patent reference), and covers issues similar to those presented in *Thomas I* and *II*.

STATEMENT OF THE ISSUE

Thomas seeks claims to methods for using a temperature sensor coupled to a microprocessor where external circuitry controls the speed of a cooling fan or – in a dependent claim – the speed of both the cooling fan and the microprocessor's clock based on a "temperature measurement" that it receives from the temperature sensor, as well as information about the "operational mode" of the microprocessor. Pippin teaches monitoring the microprocessor temperature and sending an "interrupt" signal to external circuitry when a threshold temperature is reached, thereby activating a cooling fan or reducing clock speed. The Board found that Thomas's claims were obvious in view of Pippin, Swamy (which uses information about the fan's on/off status – *i.e.*, its "operational mode" – as an input to its control circuitry), and Ikedea (which uses information about whether the clock is in normal mode or power-saving mode – *i.e.*, its "operational mode" – as an input to its control circuitry).

The issues on appeal are: (i) whether Pippin's interrupt signal meets the "temperature measurement" limitation of the claims, and if not, whether it would have been obvious to rearrange Pippin's configuration in view of Ikedea's explicit teaching of a temperature measurement that is sent directly to external circuitry to manage the temperature of the processor; (ii) whether Swamy's use of its fan status information meets the "operational modes" limitations of Thomas's claims 4 and 6;

(iii) whether Ikedea's use of normal and power saving mode information meets the "operational modes" limitations of claims 7 and 19; and (iv) whether substantial evidence supports the Board's making of the aforementioned combinations.

STATEMENT OF THE CASE

This appeal involves the examination of U.S. Patent Application No. 13/099,285 ("the '285 application" or "the Thomas application"), filed on May 2, 2011. Appx22.[1] The '285 application claims priority through a lengthy series of continuing applications back to U.S. Patent Application No. 08/264,754, filed on June 20, 1994, and issued as U.S. Patent No. 5,752,011, on May 12, 1998.[2] Appx22. The Examiner rejected claims 4-8 and 11-19 of the '285 application under 35 U.S.C. § 103(a) as obvious over the combination of Pippin,[3] Ikedea,[4] and

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[1] "Appx__" refers to the joint appendix in this case; "Br. at __" refers to Thomas's Opening Brief.

[2] All of the claims of the parent '011 patent were cancelled as a result of an interference proceeding (between Thomas as the junior party and Pippin as the senior party) involved in *Thomas I.*

[3] U.S. Patent No. 7,216,064 B1, titled "Method and Apparatus for Programmable Thermal Sensor for an Integrated Circuit," filed Apr. 19, 1996, and claims priority to U.S. Patent Application No. 08/124,980, filed on Sept. 21, 1993. Appx387-410.

[4] U.S. Patent 5,664,201, titled "Drive Control System for Microprocessor According to Operational State and Ambient Temperature Condition Thereof," filed Apr. 12, 1993. Appx379-386.

Swamy.[5] Appx214-224. The Board affirmed. Appx1-9 (decision on appeal); Appx10-14 (decision on request for rehearing).[6]

Independent claim 4 recites a method for managing the temperature of a computing apparatus by activating a fan and controlling the fan's speed dependent on the microprocessor's temperature, as well as information about the "operational mode" of the microprocessor. Appx251. Thomas challenges the Board's affirmance of the rejection of claim 4, arguing that the Board neglected to consider the thermal sensor's location or the fact that Pippin's thermal sensor generates an interrupt signal, which is not a "temperature measurement" as claimed, and renders nonobvious Thomas's claims over Pippin. Br. at 11; Br. at 15-25. Thomas also challenges the Board's affirmance of the rejection of dependent claims 6, and 7 and 19, separately, but on the same basic assertions as his arguments with regard to

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[5] U.S. Patent 5,623,594 B2, titled "Embedded Thermistor for On-Board Thermal Monitoring of Electrical Components," filed Jan. 18, 1996, and claims priority to U.S. Patent Application No. 200,267, filed Feb. 23, 1994. Appx369-378.

[6] The Board also affirmed the Examiner's rejection of claims 9-10 under 35 U.S.C. § 103(a) as obvious over the combination of Pippin, Ikedea, Swamy, and Gunn (U.S. Patent No. 5,436,827). App223-224.

During prosecution the Examiner also rejected all of the pending claims (4-19) on grounds of non-statutory obviousness-type double patenting over claims 1-28 of Thomas's U.S. Patent No. 7, 937,599. Appx264-265. The '599 patent was the subject of an interference proceeding involved in *Thomas II*. Because all of the claims of the '599 patent were cancelled in that interference, the Board did not reach the merits of the double patenting rejection. Appx4.

claim 4. Br. at 13-14; Br. at 31-35, 36-44. The remaining dependent claims (5 and 8-18) stand or fall with Thomas's challenge to independent claim 4.

A. The Thomas application: monitoring the temperature of a microprocessor and adjusting either or both the speed of the microprocessor or the speed of the cooling fan accordingly

The Thomas application is generally directed to a method for "thermally managing temperature of a computing apparatus" by controlling a microprocessor's clock speed or fan speed (or both) based upon temperature sensor readings of the microprocessor. Appx26 (¶¶ [00016-00017]); Appx29 (¶ [00032]). A block diagram of the high-level architecture of the claimed method is depicted in Figure 9, copied below. Appx37 (¶ [00054]).

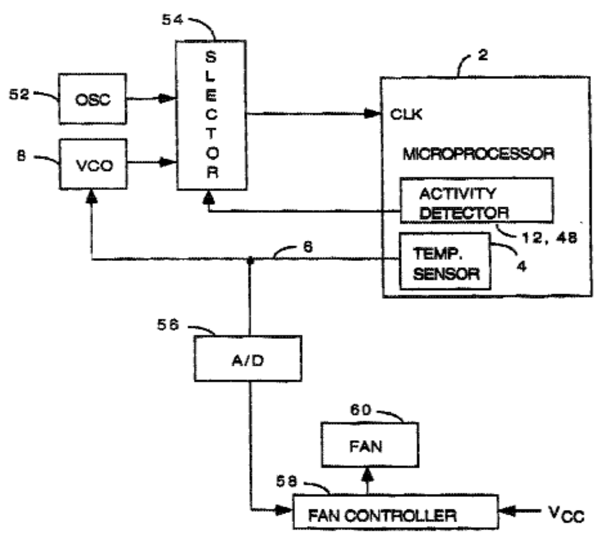


FIG. 9

As described in the specification, the temperature sensor 4, which is "thermally coupled" with the microprocessor 2, is responsive to temperature changes of the microprocessor 2 and produces a temperature signal 6, which is supplied to the voltage-controlled oscillator (VCO) 8. Appx29-30 (¶¶ [00035-00036]). The application explains that the "[t]emperature sensing circuitry is well known and therefore [need] not [be] further described." Appx29-30 (¶ [00035]). The VCO produces a clock frequency that is dependent on the value of the temperature signal. Appx30 (¶ [00036]).

Further, the VCO also receives from the activity detector 12 a signal that indicates when activity exists, and processing is therefore needed. Appx31 (¶ [00038]). When processing is needed, the VCO produces a fast clock. Appx31-32 (¶ [00039]). When no or little processing is needed, the VCO will produce a sleep or slow clock. *Id*. However, when processing is needed but the chip temperature is "hot," the VCO produces a normal clock. Appx35-36 (¶¶ [00050-00051]). The temperature signal is the digital 1 or 0 output of the temperature sensor 4—"0" when the chip is not "hot" and "1" when the chip is "hot." *Id.* Likewise, the activity signal is "0" when no activity is detected and "1" when activity is detected. *Id.*; *see also* Appx34 (¶ [00047])

Thomas discloses that multiple activity indicators can be used to generate a corresponding clock mode. Appx36-37 (¶ [00053]). But, in each scenario, the

computer responds to the output of the temperature sensor and adjusts the clock speed of the microprocessor accordingly. Table 1 represents an example of the selection of three clock modes (sleep, fast, normal) based on two select inputs. Appx35-36 (Table 1; ¶¶ [00050-00051]).

TABLE I

IN1	IN2	CLK Mode
0	0	Sleep
0	1	Fast
1	0	Sleep
1	1	Normal

Referring back to Fig. 9 above, the thermal sensor can also trigger an adjustment to the speed of "a temperature-activated, variable-speed fan" 60. Appx37 (¶ [00054]). The fan controller 58 performs pulse-width modulation to control the activation and speed of the cooling fan 60 in accordance with the output of the temperature sensor. *Id*. The fan controller optimizes the use of the fan with the speed of the clock. Appx37-38 (¶ [00055]).

Claim 4 is illustrative of the above examples and recites use of a thermal sensor that monitors a microprocessor's temperature and signals a corresponding adjustment to the speed of the fan based in part on the "operational mode" of the microprocessor. Claim 4 provides:

> 4. A method for thermally managing temperature of a computing apparatus having a microprocessor, the microprocessor operating in accordance with a clock having a clock frequency, the microprocessor including an internal temperature sensor, the computing apparatus including circuitry external to the microprocessor for thermal

> management, the computing apparatus including a fan controllably operable to cool at least a portion of the computing apparatus, the method comprising:
>
> receiving, at the circuitry external to the microprocessor, a temperature measurement of the microprocessor from the internal temperature sensor;
>
> managing the temperature of at least the microprocessor of the computing apparatus based at least in part on the temperature measurement provided at least in part by the temperature sensor;
>
> determining which of at least two operational modes the computing apparatus is operating;
>
> retrieving fan control data dependent on at least the operational mode the computing apparatus is operating;
>
> comparing, at the circuitry external to the microprocessor, the temperature measurement with the fan control data to produce fan speed data; and
>
> controlling speed of the fan based on the fan speed data.

Appx251. Dependent claim 6 additionally requires that "the temperature measurement is provided to the circuitry external to the microprocessor without any substantial alteration or hindrance to the temperature measurement." Appx252. Additionally relevant here, dependent claims 7 and 19 further recite controlling the clock speed based on the temperature of the processor as well as the "operational mode" of the microprocessor. Appx252, Appx254-255.

In the "background" section, Thomas's application acknowledges that the prior art taught the use of a fan to control the temperature of a microprocessor.

Appx25 (¶ [00014]) ("[M]anufacturers [of portable computers] have to either use a lower clock frequency (lower than would be used in a comparable desk top computer) for processing or provide a fan for cooling."); *Id.* ("Requiring a portable computer to use a fan for cooling is also unsatisfactory because it consumes battery energy"); *see also* Appx24 (¶ [00013]). It further provides that the problem with prior solutions to energy conservation in computing devices is that the processors may still overheat due to not entering sleep mode during prolonged activity. Appx25 (¶ [00013]). The Thomas application states that the advantages of its invention "enable a computing device to maximize its processing speed while, at the same time, preventing overheating." Appx25 (¶ [00015]).

B. Prior art: power and thermal management techniques based on the temperature of the microprocessor

The prior art is directed to known design choices in methods and systems for providing power and thermal management of computer systems. An artisan of ordinary skill at the time of the invention – June 20, 1994 – is presumed to have knowledge of the use of thermal sensors to monitor processor temperature by comparing a temperature measurement of the processor against different threshold temperatures, at which certain instructions are carried out to activate a fan, control the fan's speed, or the clock speed of the microprocessor.

1. Pippin: use of a programmable thermal sensor to activate a cooling fan and reduce the clock speed of the microprocessor

Pippin, like the Thomas application, describes configurations where the thermal sensor is located internal to a microprocessor. Appx387 (Abstract). Pippin discloses that the thermal sensor is programmed to (1) detect when the microprocessor's temperature exceeds predetermined thresholds and to (2) generate an interrupt signal in response. Appx387 (Abstract). Fig. 9 (below) depicts a block diagram of the programmable thermal sensor 110 internal to the microprocessor 900. Appx398.

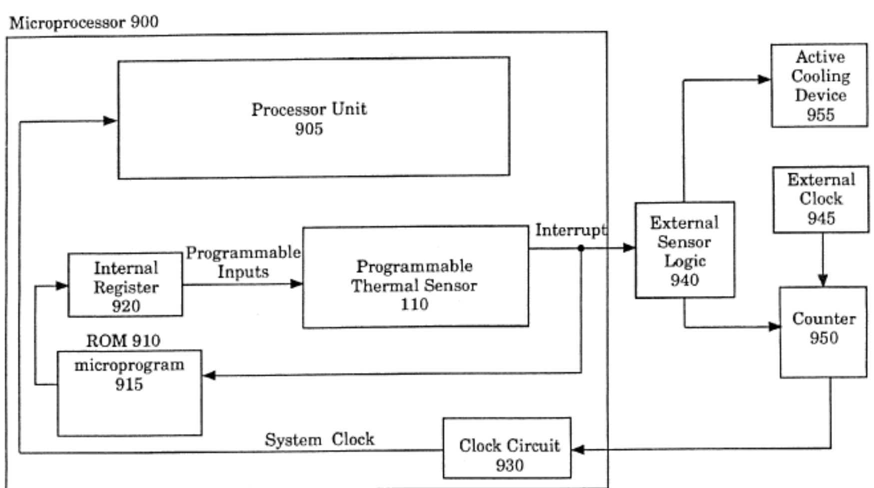


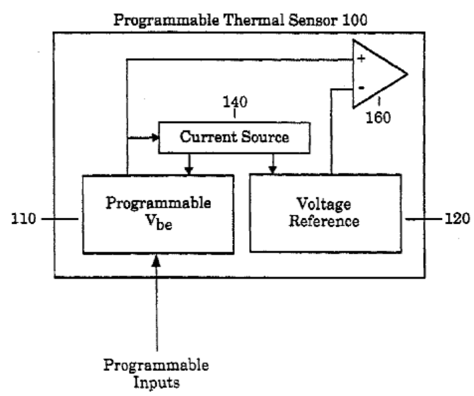
FIG. 9

According to the specification, the programmable thermal sensor 110 monitors the temperature of the microprocessor 900 and generates an output "interrupt" signal in response to meeting different temperature thresholds. Appx402 (col.4, ll.53-67). External to the microprocessor 900 is an external clock

945 coupled to a counter 950 and an "active cooling" device 955, such as a fan. Appx398 (Fig. 9); Appx406 (col.12, ll.38-67). On receiving the interrupt signal at the external sensor logic 940, the processor executes instructions to either reduce the operational speed (clock frequency) 945 of the microprocessor or activate or increase the speed of the fan 955, or both.

The programmable thermal sensor 100 (illustrated in Fig. 1, copied below) contains a voltage reference 120, a programmable V_{be} 110,[7] a current source 140, and a sense amplifier 160. Appx402 (col.4, ll.53-55); Appx390 (Fig. 1).

FIG. 1



The programmable V_{be} 110 contains a sensing portion and a multiplier portion, that generates an output voltage based on the temperature of the microprocessor. Appx402 (col.4, l.63-col.5, l.2). For example, a reference voltage

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[7] Although Fig. 9 (copied on the previous page) and its associated text use reference number 110 for the programmable thermal sensor instead of 100, reference number 110 was first assigned to the programmable V_{be} in Fig. 1.

of 1.3 V is generated when the temperature of the microprocessor is at 100° F. Appx403 (col.5, ll.5-19). Fig. 2 (copied below) depicts the relationship between V_{be} and the temperature of the microprocessor. *Id*.

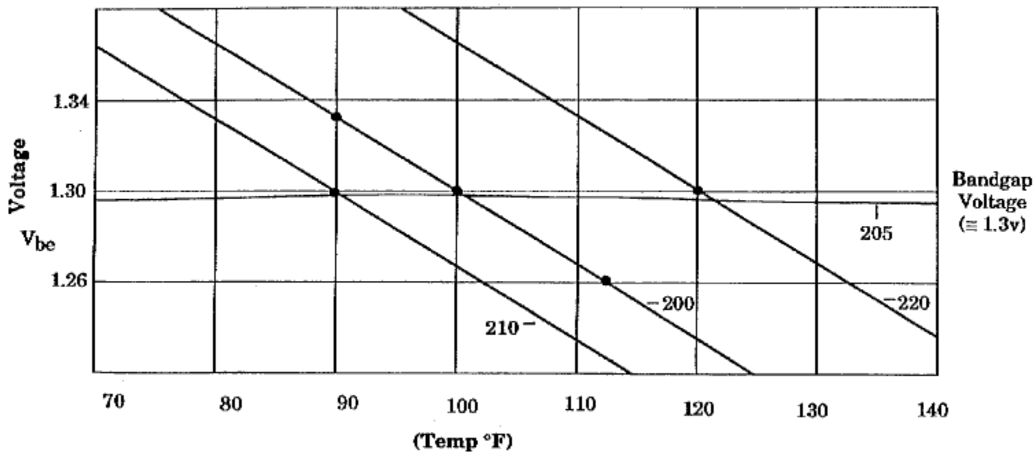

FIG. 2

The characteristic curve 200 above can be modified to sense different threshold voltages (other than 100°F). Appx403 (col. 5, ll.30-45). To shift the characteristic curve, the V_{be} voltage is multiplied by a constant value to move the curve while exhibiting the same slope. *Id*. In addition, multiple characteristic curves can be used to detect multiple threshold temperatures. *Id*.

2. Ikedea: use of a temperature sensor to execute instructions to lower the microprocessor's clock speed and power consumption

Similar to Pippin, Ikedea teaches a computer system 1 comprising a microprocessor (Fig. 1, CPU, 2), a temperature sensor 10, and controlling the microprocessor clock speed based on the output of the temperature sensor. Appx380 (Fig. 1, depicted below).

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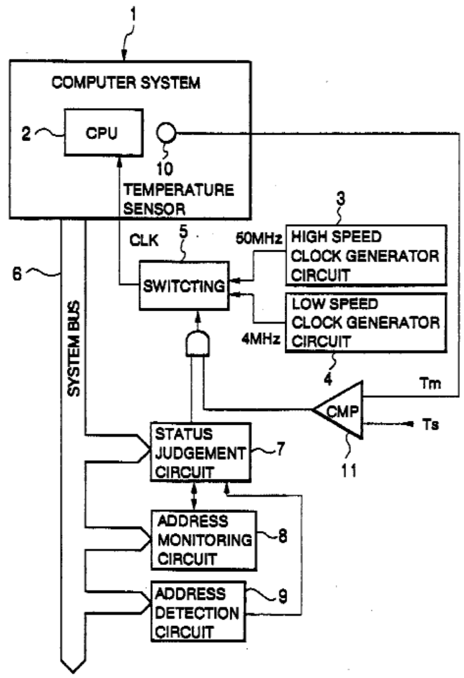

In operation, the temperature sensor 10 detects the temperature T_m of the microprocessor 2 and outputs a "temperature indicative signal representative" of a detected temperature T_m to a comparator 11. Appx385 (col.8, ll.33-44). The comparator is located external to the microprocessor, and also depicted external to the computer system. Appx380 (Fig. 1). The comparator periodically compares the detected temperature T_m with a predetermined set temperature T_s. Appx385 (col.8, ll.44-46). Based on the comparison, the comparator outputs the result to the switching circuit 5 which controls the two clock speed modes – high speed clock 3 or low speed clock 4. Appx385 (col.8, ll.46-58); Appx383-384 (col.4, ll.58-col.5, ll.7). When the detected temperature is above a certain predetermined level T_s, the switching circuit 5 switches to operate the microprocessor in "low speed" mode.

Appx385 (col. 8, ll.50-58). The switching circuit then outputs the clock signal back into the microprocessor. Appx385 (col.8, ll.52-58); Appx380 (Fig. 1).

3. Swamy: use of a temperature sensor to provide fan control and adjust the microprocessor's clock speed

Like Pippin and Ikedea, Swamy teaches monitoring the temperature of a microprocessor with a temperature sensor (overtemperature detection circuit 210) to prevent overheating of the microprocessor. Appx369 (Abstract); Appx376 (col. 7, ll.9-14); Appx372 (Fig. 3). As illustrated in the flow chart of Fig. 3 (depicted below), Swamy discloses on-board thermal monitoring of the microprocessor.

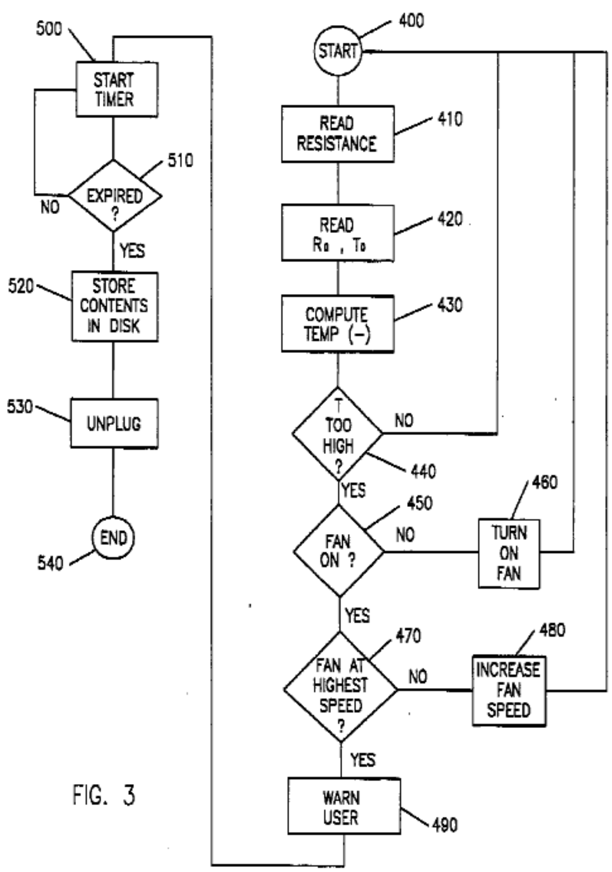

FIG. 3

The “overtemperature” detection circuit takes temperature readings of the microprocessor on a predetermined periodic basis 410, 430. When the microprocessor’s operating temperature is excessive (i.e., over a predetermined level) [440], an instruction is sent from the overtemperature detection circuit to a fan, the instruction being to turn the fan on (when the fan is off) [450, 460]. Appx376 (col.7, ll.54-58); Appx373 (col.2, ll.46-49). If the fan is already on, the instruction is to increase the fan’s speed [470, 480]. Appx376 (col.7, ll.58-60); Appx373 (col.2, ll.46-49). If the fan is already on at its highest speed and the temperature is still too high, the overtemperature circuit, as a last resort, may send an instruction to warn the user [490] and, if the user fails to respond, send an instruction to the microprocessor to save any work and turn the computer off [520, 530]. In addition, and in a similar manner to Pippin and Ikedea, Swamy also teaches sending an electronic instruction to modify the speed of the microprocessor’s clock based on the overtemperature circuit output. Appx375 (col.6, ll.58-61); Appx373 (col.2, ll.49-51).

C. Proceedings Before The Agency

The Board affirmed the Examiner’s rejection of claims 4-8 and 11-19 as obvious over the combination of Pippin, Ikedea, and Swamy. Appx4; Appx209-225 (decision from which the appeal was taken); Appx263-290 (Examiner’s Answer). In agreeing with the conclusions of the Examiner, the Board adopted as

its "own the findings and reasons of the Examiner set forth in the action from which the appeal was taken[8] and the reasons set forth in the Examiner's Answer." Appx4.

1. Claim 4

The Examiner found, and the Board agreed, that Pippin discloses either explicitly, expressly, or implicitly all of the limitations of method claim 4 (including the structural limitations recited in the preamble). Appx4-6; Appx215-217. To the extent Pippin does not explicitly disclose "retrieving" fan control data dependent on the operational mode of the microprocessor and "comparing" the temperature measurement with the fan control data to produce fan speed data, the Examiner found that Swamy discloses controlling fan speed based on the temperature measurement of the microprocessor, and the "operational mode" of the fan (on/off). Appx6; Appx217-219; Appx283-284. The Board further relied on Ikedea's explicit disclosure of a computing device configuration having a microprocessor with an internal temperature sensor and circuitry external to the microprocessor for "receiving" the temperature measurement for comparison as teaching the step of receiving a temperature measurement at external circuitry. Appx 6; Appx216-217; Appx282.

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[8] The appeal was taken as of right from a non-final office action dated Sept. 17, 2013, following reopening of prosecution in view of an initial appeal brief. Appx209-225.

The Examiner next found that one of ordinary skill in the art at the time of the invention would have been motivated by Ikedea to couple only the sensing portion of Pippin's thermal sensor 100, with the microprocessor and implement the other components of Pippin's thermal sensor on an external circuit, as taught by Ikedea, because the modification would "reduce the cost of the microprocessor." Appx217; Appx282. The Examiner explained that "in the event that the microprocessor needs to be replaced because of the failure of the processing unit, a user would pay less for the microprocessor with only the 'sensing portion' integrated therein." Appx282.

Next, the Examiner found that it would have been obvious to combine the teachings of Pippin and Ikedea with Swamy to control the fan speed based on retrieving fan control data dependent on the operational mode of the processor because the modification would increase the reliability of the overall system. Appx219; Appx283-285. Citing *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007), the Board held that the Examiner's reasoning articulating reduced cost and increased reliability satisfies the requirement for a reason for the proposed combination. Appx6-7.

In response to Thomas's argument that Pippin's interrupt signal is a control signal derived from an internal temperature measurement and not a "temperature measurement" received by external circuitry as required by claim 4, the Board

endorsed the Examiner's view that the interrupt signal is sent to "indicate" that the microprocessor has attained or exceeded a specific temperature value, or a threshold temperature. Appx6; Appx13. The Examiner further noted that external sensor logic 940 in Pippin's Figure 9 receives the interrupt signal from the internal programmable thermal sensor 110 when the temperature of the microprocessor rises to the programmed threshold temperature, e.g., 100°F. Appx215-216. Therefore, one of ordinary skill in the art would recognize that the interrupt signal indicates that the temperature of the microprocessor is 100°F. *Id.* (citing Appx406 (col.12, ll.34-42)); Appx403 (col.5, ll.3-19).

In his Answer, the Examiner maintained that Pippin discloses the recited "receiving" step and further explained that Pippin's thermal sensor's programmable V_{be} includes a sensing portion and a multiplier portion, where the temperature of the microprocessor is measured by the sensing portion. Appx281-282. Alternatively, the Examiner also found that should the Pippin reference not be considered to teach the "receiving" step, Ikedea discloses a temperature sensor coupled to a microprocessor, which then outputs the temperature of the microprocessor to an external circuit for comparison. Appx282; *see also* Appx6.

2. Dependent claim 6

Regarding the rejection of dependent claim 6 – further reciting that the "temperature measurement is provided to the circuitry external to the

microprocessor without any substantial alteration or hindrance to the temperature measurement" – the Board recognized that Thomas's arguments as to this rejection were nearly identical to those he advanced regarding claim 4. Appx7. The Board, therefore, reiterated its finding that "the interrupt signal of Pippin is indicative of a temperature measurement that is above a threshold and is directly provided to the external circuitry." Appx7; Appx219; Appx285-286. The Examiner had also noted that the temperature indication comes from an initial temperature measurement. Appx285. The Examiner also emphasized that Ikedea explicitly teaches a temperature measurement that is provided to the external circuitry without "substantial alteration or hindrance." Appx285-286. On rehearing, the Board was not persuaded that it "improperly relied on an incorrect understanding of a temperature measurement." Appx14.

3. Dependent claims 7 and 19

Likewise, the Board found that Thomas's arguments with regard to dependent claims 7 and 19 – reciting controlling the clock speed of the microprocessor based on the temperature of the microprocessor and the "operational mode" of the system – are premised on the same assertions as those made with respect to claim 4 relating to Pippin's teaching of a temperature measurement external to the microprocessor. Appx8. Accordingly, the Board maintained its determinations with regard to claims 4 and 6 – that "the interrupt

signal of Pippin relates to a temperature measurement that identifies temperatures above a threshold." *Id*. Furthermore, the Board also agreed with the Examiner's findings that Ikedea's disclosure of switching between high and low clock speed modes "based on the temperature of the microprocessor, correspond to the normal mode and the power saving mode of the microprocessor, respectively." Appx8 (citing Appx286).

As the Examiner explained in more detail, Ikedea's system architecture teaches that the temperature measurement T_m is output to a comparator, which is located outside the microprocessor and also depicted external to the computer system. Appx287-288. Based on the comparison result, the comparator outputs the result to the switch circuit which controls the two clock speed modes (high or low clock speed modes). Appx287; Appx289. The switching circuit then outputs the clock signal back into the microprocessor. *Id.* As such, the Board found that those cited portions of Ikedea teach the recited "'clock control data' . . . dependent on operational mode of a computing apparatus." Appx8.

SUMMARY OF THE ARGUMENT

The claims on appeal are generally directed towards the concept of controlling a processor's clock speed and fan speed based on a temperature sensor reading and the "operational mode" of the microprocessor. Pippin expressly teaches all of the claimed limitations other than the "operational mode" limitations

and – arguably – the temperature measurement limitation. Ikedea and Swamy disclose the operational mode limitations, and Ikedea further provides any missing teaching regarding the temperature measurement limitation. Because there was ample motivation to combine these references to meet Thomas's claims, Thomas's claims would have been obvious.

Thomas's primary argument to this Court is based on a construction of the term "temperature measurement" that is improperly narrow. It is the Board's construction that comports with the broadest reasonable interpretation consistent with Thomas's specification, not Thomas's. Furthermore, Thomas's proposed interpretation is circular: "temperature measurement must be a measurement of temperature obtained from an internal temperature sensor." The Board and the Examiner correctly found that the interrupt signal in Pippin, which is outputted from a programmable thermal sensor when the microprocessor attains a temperature above a threshold, is within the scope of "temperature measurement." That is how Thomas's own disclosed device works, by outputting a 1 or 0 depending on whether the microprocessor is hot. Regardless, even under Thomas's construction, the Board found that Pippin explicitly states that the temperature of the microprocessor is measured by a sensing portion of the internal thermal sensor.

Thomas also attempts to attack the combination of Pippin with Ikedea by arguing that because Ikedea's temperature sensor is external to the microprocessor,

it is not "a temperature measurement of the microprocessor from the internal temperature sensor," and is unable to be combined with Pippin. But substantial evidence supports the Board's determination that the desire for cost savings would have motivated a person with ordinary skill in the art at the time of the invention to integrate only the sensing portion of Pippin's thermal sensor within the microprocessor while implementing the other components of the thermal sensor on an external circuit as taught by Ikedea.

Likewise, as the Board found, the desire to achieve increased reliability would have motivated a person of ordinary skill in the art to combine the teachings of Pippin and Ikedea with Swamy to control the fan speed based on the operational mode of the processor.

Finally, the challenges to limitations of the dependent claims are also unfounded. Pippin meets the limitation "the temperature measurement is provided to the circuitry external to the microprocessor without any substantial alteration of hindrance to the temperature measurement," as recited in claim 6, since Pippin's interrupt signal is directly provided to external circuitry. In any event, Ikedea explicitly teaches a temperature measurement that is provided to the external circuitry without change. As to claims 7 and 19, Ikedea teaches two operational modes of the microprocessor and the claimed "clock control data" as recited in those claims.

ARGUMENT

A. Standard of Review

Thomas has the burden to show that the Board committed reversible error. *In re Watts*, 354 F.3d 1362, 1369 (Fed. Cir. 2004). "During examination, claims . . . are to be given their broadest reasonable interpretation consistent with the specification." *In re Montgomery*, 677 F.3d 1375, 1379 (Fed. Cir. 2012) (quotation omitted). This Court reviews that construction to determine whether it is reasonable in light of all the evidence before the Board. *See, e.g.*, *In re Etter*, 756 F.2d 852, 858 (Fed. Cir. 1985) (en banc); *In re Morris*, 127 F.3d 1048, 1055 (Fed. Cir. 1997).

This Court reviews the Board's conclusion of obviousness *de novo*, but upholds the Board's underlying fact findings in an obviousness analysis if they are supported by substantial evidence. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 427 (2007); *In re DBC*, 545 F.3d 1373, 1377 (Fed. Cir. 2008). What a reference teaches is a question of fact. *Para-Ordnance Mfg. v. SGS Importers Int'l*, 73 F.3d 1085, 1088 (Fed. Cir. 1995). Likewise, the presence or absence of a motivation to combine references in an obviousness determination is a question of fact. *In re Gartside*, 203 F.3d 1305, 1316 (Fed. Cir. 2000). Substantial evidence "is something less than the weight of the evidence but more than a mere scintilla of evidence," *In re Kotzab*, 217 F.3d 1365, 1369 (Fed. Cir. 2000), and "means such

relevant evidence as a reasonable mind might accept as adequate to support a conclusion," *Consol. Edison Co. v. NLRB*, 305 U.S. 197, 229 (1938).

B. Substantial Evidence Supports the Board's Finding That the Combination of Pippin, Ikedea and Swamy Renders Claim 4 Obvious

A claimed invention is unpatentable if the differences between it and the prior art "are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art." 35 U.S.C. § 103(a). To assess whether the subject matter would have been obvious, this Court follows guidance in *Graham v. John Deere Co.,* 383 U.S. 1 (1966) and *KSR*, 550 U.S. 398 (2007). Under that guidance, an "expansive and flexible approach" must be applied, and courts may utilize "common sense" in addressing obviousness under § 103. *KSR*, 550 U.S. at 415-16. In other words, "a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions." *KSR*, 550 U.S. at 417.

1. Pippin alone would render claim 4 obvious

As the Examiner and the Board found, claim 4 is obvious based on the teachings of Pippin alone, which discloses activating a fan and reducing clock frequency in response to the temperature measurement of the microprocessor exceeding a known threshold temperature, e.g., 100°F, when Pippin's interrupt signal is received. Appx215-219; Appx5-7. The following table identifies where Pippin discloses the various steps recited in claim 4, as found by the Examiner:

Claim 4	**Pippin**
4. A method for thermally managing temp. of a computing apparatus, . . . the method comprising:	Fig. 9 (Appx398) 900 (processor) 110 (temp. sensor) 940 (external circuity) Appx401 (col.2, ll. 56-63; col.2, ll. 51-52). Appx215.
"receiving," at the circuitry external to the processor, a temp. measurement of the processor from the internal temp. sensor;	external logic 940 receives interrupt signal from internal temp. sensor 110 when temp. of the processor rises to the programmed threshold temp., e.g. 100°F Appx215.
"managing" the temp. of at least the processor of the computing apparatus based at least in part on the temp. measurement provided at least in part by the temp. sensor;	when the temp. of the processor rises to threshold temp., cooling fan is activated and/or system clock frequency is reduced Appx406 (col.12, ll.38-67). Appx215.
"determining" which of at least two operational modes the computing apparatus is operating;	whether the system operates at a temp. (i) less than first temp. threshold value (normal mode); or (ii) equals or greater than first temp. threshold value (frequency reduced mode)) Appx406 (col.11, ll.55-61; col.12, ll. 38-67). Appx216.
"retrieving" fan control data dependent on at least the operational mode the computing apparatus is operating;	it is well understood that one of ordinary skill in the art that the computer system would determine the status of the fan (on or off) prior to controlling the fan. Appx406 (col.12, ll.38-42). Appx216.
"comparing" at the circuitry external to the processor the temp. measurement with the fan control data to produce fan speed data; and	provides for "active cooling" of the processor through feedback control of the fan and clock circuitry; stepwise control of fan speed based on processor performance/ temperature would have been routine, obvious modification based on Pippin's teaching of providing rapid and "active cooling"
"controlling" the speed of the fan based on the fan speed data.	the pre-determined temp. thresholds are used for continuous active control of the fan Appx406 (col.12, ll.38-42). Appx216.

As the Examiner and the Board found, Pippin teaches configurations (e.g., Fig. 9 depicted below) where the thermal sensor 110 is internal to the microprocessor 900. Appx5; Appx215; Appx266; Appx 280-281. In operation, Pippin's thermal sensor, specifically through the programmable V_{be} 110, is programmed to detect when the microprocessor's temperature exceeds particular threshold temperatures and generates an "interrupt" signal in response to above-threshold temperature measurement. Appx6; Appx280-281. As the Board found, the interrupt signal provides a measurement of microprocessor temperature by "indicating" whether the temperature is above or below a threshold. Appx215-216; Appx13. That is also how Thomas's own device operates. Thus, the programmability of the Pippin sensor by definition provides sensing of a specific temperature measurement. *See id.* Upon "receiving" the interrupt signal, the external sensor logic "manages" the temperature of the processor by turning on a fan or reducing the clock frequency (speed) for the microprocessor. A215; A267.

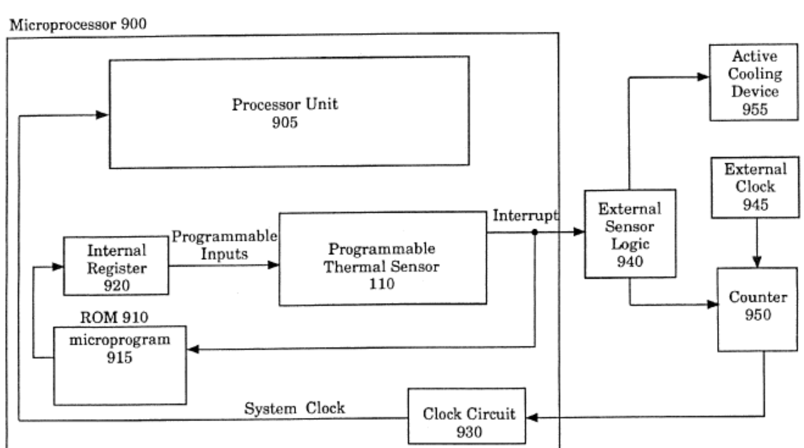


FIG. 9

The Examiner also found that Pippin speaks to the remaining "determining," "retrieving," "comparing," and "controlling" steps relating to control of the fan based on the operational mode of the system and control of fan speed based on processor temperature. *See* Appx216; Appx267. As explained, the system operates in "normal mode" when the temperature of the microprocessor is below the threshold, A216, and in "frequency reduced" mode in response to the temperature of the microprocessor exceeding a first threshold temperature. Appx215-216 (citing Appx406 (col.11, ll.55-61); (col.12, ll.38-67)). Pippin further teaches activating a fan at the "frequency reduced mode," and further teaches that if the microprocessor continues to heat up and exceeds a new, higher threshold temperature, the clock frequency is further reduced. Appx215 (citing Appx406 (col.12, ll.38-67)). Thus, Pippin's "active cooling" of the microprocessor by continuously monitoring the temperature and "automatically reducing the temperature when overheating occurs" by activating the fan and providing feedback control of the clock circuitry would have suggested to one of ordinary skill in the art to similarly control fan speed based on processor temperature in an optimal manner that depends on the operating mode of the computer system. *See id.* Thus, at a given temperature, a fast mode may activate the fan, and a temperature-regulated frequency reduced mode may increase the fan's speed.

2. The Board's claim construction of "temperature measurement" is proper and Pippin would read upon the claimed step even under Thomas's construction

Thomas contends that Pippin's interrupt signal cannot be equated to "a temperature measurement of the microprocessor" and that the Board improperly interpreted the claim language unreasonably broadly to cover a "temperature indication." Br. at 17. Thomas's proposed claim construction is that "the temperature measurement . . . is a measurement of temperature that is obtained from an internal temperature sensor." Br. at 19. Considering that the claim language already recites "a temperature measurement of the microprocessor from the internal temperature sensor," this proposed definition seems to be circular and redundant. Appx251. In any event, the distinction Thomas attempts to draw seems to be that the interrupt signal from Pippin is a control signal, not a temperature measurement. Br. at 20. Pursuing this line of argument, upon its output from the comparator, it no longer is a temperature measurement – "even if it is *indicative* of a temperature measurement." *Id*.

But the claim language does not require such an overly selective reading of Pippin. As the Board and the Examiner found, the interrupt signal plainly qualifies as a "temperature measurement" because, as one of ordinary skill would recognize, it indicates whether the temperature of the microprocessor attains the specific threshold temperature value, e.g., 100°F. Appx6, Appx12, Appx281. Accordingly,

the Board correctly found that "[a]lthough the signal itself may not be in the form of a value in degrees, the outputted signal is an indication or measurement of whether the microprocessor is getting hot or is still operating in a safe temperature range, *i.e.*, a temperature measurement." Appx13.

Nor does Thomas's specification impose such restrictions. In fact, Thomas's specification describes its temperature signal 6 as an analog voltage signal ranging from 0 to 5 volts, which is supplied to a voltage-controlled oscillator to produce a corresponding clock signal and an analog-to-digital converter to produce a digital signal supplied to the fan controller. *See* Appx13 (citing Thomas's Application, at Appx30 [¶ 00036]). One of ordinary skill would have understood that Thomas's processor temperature is monitored using threshold temperatures in order for its thermal sensor 4 to both control clock speed and fan speed based on processor temperature and the operational mode of the system. *See* Appx34-35 ([¶¶ 00047-00049]). The application further depicts, at least in Table 1, a temperature sensor 4 that has a digital one or zero output. *Id.*; *see also* Appx35-36 ([¶¶ 00050-00051]). One of ordinary skill in the art would have understood that the digital output indicates that the temperature measurements are compared against temperature thresholds. Appx36 (Table 1). In light of this, it is unclear why Thomas continues to argue that Pippin fails to teach a "temperature measurement."

And on a practical level, what this argument may be driving at is a level of temperature specificity that is not claimed. Any output will necessarily only be representative of temperature on some arbitrary scale, whether the output is a binary hot/not-hot indicator, a single-digit indicator of general Fahrenheit temperature, or a multi-digit precise indicator on some other scale. Temperature is simply a physical state of something and can be expressed in a nearly limitless manner of ways. The fact that the prior art sends a binary output just like Thomas's own structure should end the debate.

What Thomas might be complaining about is the Examiner's allegedly improper citation to the interrupt signal of Pippin rather than the programmable V_{be} circuit 110. Br. at 20-21. Indeed, Thomas admits that the sensing portion of the programmable V_{be} circuit "provides a temperature measurement," that is then compared with the reference voltage to generate the interrupt signal. Br. at 19; Br. at 33. However, once the claim term is properly construed in the context of the claimed step – "<u>receiving</u>, <u>at the circuitry external</u> to the microprocessor, a temperature measurement of the microprocessor from the internal temperature sensor" – there is ample explanation for why the Examiner cited the interrupt signal and not the combination of the programmable V_{be} circuit and the interrupt signal. Appx12; Appx281. As the Board explained, the interrupt signal was cited because it is generated by the internal temperature sensor coupled to the

microprocessor and then received at circuitry external to the microprocessor, as claimed. Appx12; *see also* Appx281 (explaining that "the signal (interrupt) outputted from the temperature sensor is to indicate the temperature of the microprocessor."). Thus, regardless of Thomas's distinction between indication and measurement, Pippin teaches both.

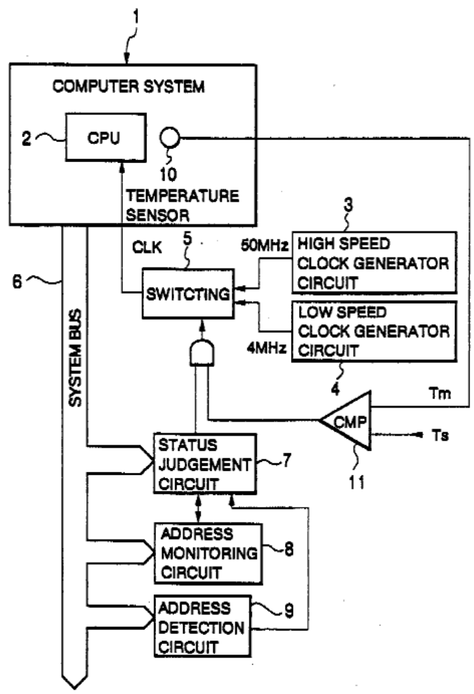
3. Ikedea and Swamy explicitly disclose the steps that are implicitly taught by Pippin

Because each of the allegedly distinguishing features that Thomas identifies in his brief are directly disclosed in Pippin, Ikedea, or Swamy, the Board's determination that claim 4 is obvious over the combination of the prior art is supported by substantial evidence, as discussed below.

a. Ikedea expressly teaches receiving a temperature measurement at external circuitry from the internal temperature sensor

As the Board and the Examiner found, Ikedea expressly discloses a temperature sensor 10 coupled to a microprocessor that measures the temperature T_m of the microprocessor 2 and outputs a "temperature indicative signal representative" of [the] detected temperature T_m, which is "received" by a comparator located external to the microprocessor. Appx 6; Appx216-217; Appx281-282; Appx385; Appx380 (Fig. 1, depicted below).

FIG. 1



b. Swamy expressly teaches stepwise control of a multispeed fan dependent on microprocessor temperature whose instructions at a given temperature might differ depending on the operational mode of the computer system

As the Board and the Examiner found, Swamy discloses an overtemperature detection circuit that takes periodic readings of digital signals corresponding to the temperature of a trace located near a microprocessor on a circuit board. Appx6; Appx218-219; Appx283-285. The trace forms a temperature sensor for: (1) "determining" the operating mode of the computer system, "such as whether a cooling fan is to be turned on or, if the fan is on, to modify the fan speed" (Appx6); (2) "retrieving" fan control data to determine the status of the fan – *i.e.,* whether it is on or off based on a predetermined temperature threshold value (Appx218,

Appx283); (3) "comparing" the temperature of the microprocessor with the fan speed to determine whether or not to increase fan speed (Appx219, Appx284); and (4) "controlling" the fan speed by increasing its speed when the microprocessor's temperature attains a new threshold temperature and the fan is already on (Appx219, Appx284). As illustrated in the flow chart of Fig. 3 (depicted below), in one embodiment in which the fan is activated (mode 2), its speed is repeatedly increased if high temperature conditions persist. Appx372 (Fig. 3).

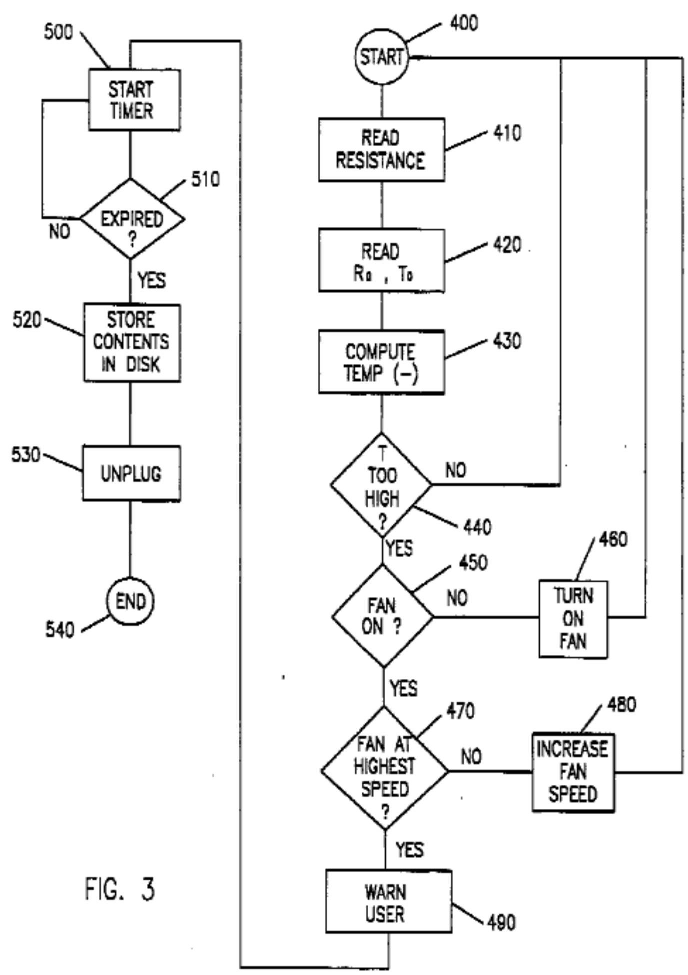


FIG. 3

4. An ordinarily skilled artisan would have modified Pippin's system to control both the fan speed and processor clock speed based on a temperature measurement of the processor in an optimal manner that depends on the operating mode of the computer apparatus

Evidence of motivation to combine references may flow from the prior art themselves, the knowledge of ordinary skill in the art, or from the nature of the problem to be solved. *See In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1988).

As explained by the Examiner in detail, an ordinarily skilled artisan would have been motivated by the configuration of Ikedea's thermal sensor 10, which measures the temperature of the microprocessor and outputs the detected temperature directly, and which is received by a comparator component located on external circuitry, to modify Pippin's thermal sensor in a similar manner. Appx217; Appx282. The Board found that leaving only the necessary sensing component with the microprocessor would reduce costs (Appx6, citing Examiner's Answer at Appx282-284) because, as the Examiner explained, "in the event that the microprocessor needs to be replaced because of the failure of the processing unit, a user would pay less for the microprocessor with only the "sensing portion" integrated therein." Appx282.

The Board and the Examiner also correctly found that one of ordinary skill in the art would have been motivated to combine the teachings of Pippin and Ikedea with Swamy to include the "necessary control signals" to control the fan speed based on retrieving fan control data dependent on the operational mode of

the processor because the modification would increase the reliability of the overall system. Appx219; Appx283-285; Appx6-7. By articulating with rational underpinning how the claimed features are suggested, the Board and the Examiner set forth a *prima facie* case of obviousness. Appx7.

Those findings have never been contested. Before the Board, Thomas offered only conclusory statements about the motivation to combine and altogether failed to show that the Board's conclusion was incorrect or that a skilled artisan would have lacked a motivation to combine. Appx6; Appx124-125 (App. Br. at 11-12). Again, before this Court, Thomas argues that "generalized rationales of cost reduction or increased reliability" for combining prior art references is insufficient justification. Appx6; Br. at 27-28. However, as the Board found, case law dictates that it is unnecessary to solve only problems made explicit by the teachings of the prior art, and common sense teaches that familiar items may have obvious uses beyond their primary purposes which a person of ordinary skill may combine to arrive at a claimed invention. Appx7 (citing *KSR*, 550 U.S. at 418, 420).

And even if the Board had not submitted "reduced cost" and "increased reliability" as support for the combination that does not necessarily mean that the substitution would have been non-obvious. Pippin, Ikedea, and Swamy disclose well-known prior art techniques for power and thermal management of microprocessors. They each teach the use of a temperature sensor coupled to a

microprocessor to monitor the temperature of the processor based on predetermined threshold temperatures, at which certain well-known instructions for cooling options are executed including activating a fan, increasing the fan speed, and decreasing the clock speed of the microprocessor. Each option has known advantages and disadvantages depending on the operational mode of the computer system. Thus, each represents well known design choices among a finite number of known methods that do no more than yield predictable results. *KSR*, 550 U.S. at 417 (If "a person of ordinary skill in the art would recognize that [a known technique] would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.").

As set forth in the passage of *KSR* relied upon by the Board: "Common sense teaches . . . that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." Appx7 (*citing KSR*, 550 U.S. at 420). Here, the combination of "familiar items" was for "their primary purpose[]" as taught in the art. *Id.*; *see also Perfect Web Techs., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1328 (Fed. Cir. 2009) ("[C]ommon sense can be a source of reasons to combine or modify prior art references."); *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1367 (Fed. Cir. 2006) (obviousness test "not only permits, but requires, consideration of common

knowledge and common sense”). Thus, the common sense reconfiguration of Pippin to incorporate the teachings of Ikedea and Swamy was a product not “of innovation but of ordinary skill.” *KSR*, 550 U.S. at 421.

Thomas’s remaining arguments against the prima facie case amount to improper piecemeal attacks on the references individually and without consideration of the full import of the Board’s analysis of the prior art references as a whole. First, Thomas contends that Ikedea’s temperature sensor is located near the microprocessor rather than within it, and therefore cannot teach the limitation of “a temperature measurement of the microprocessor from the internal temperature sensor.” Br. at 21-22. However, Ikedea was not necessarily relied upon for its teaching of an *internal* temperature sensor, which Pippin already clearly discloses with the programmable V_{be}. Appx217-219; Appx281-282. Instead, it was relied upon to show its teaching of disclosing a numerical “temperature measurement” of the microprocessor temperature that is received by the external circuitry. Appx13. Therefore, Thomas’s argument that Ikedea’s temperature sensor 10 is external to the microprocessor is not salient. *See* Appx13; *see also* Thomas’s specification at Appx29 (¶[00035]) (providing that the internal temperature sensor can be “either integrated within the . . . microprocessor 2 or placed in contact with the housing or package,” so long as it is “thermally coupled with the microprocessor 2.”).

Second, Thomas alleges that Ikedea and Swamy teach away from an internal thermal sensor because the references teach against circuitry necessary to generate an interrupt signal internal to the microprocessor. Br. at 28. However, Pippin does not need an additional rationale to be modified to include an internal thermal sensor because it has one already in the form of the V_{be} circuit. Furthermore, Ikedea and Swamy do not teach away from using circuitry internal to a microprocessor for temperature measurement, as Thomas alleges, because teaching away requires more than a preference for a particular design choice. *In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012); *Para-Ordnance*, 73 F.3d at 1090. Moreover, that is not how Pippin's system is being modified. Pippin is being modified by Ikedea to output the temperature value measured by the temperature sensor to the external circuit to manage the temperature of the *entire system*, including the microprocessor. Appx269. In other words, Pippin is being modified to allow for the temperature measurement to control other external devices or components.

C. Thomas's Arguments as to the Dependent Claims (6, 7 and 19) are Unavailing

1. Dependent claim 6

Dependent claim 6 adds the limitation that "the temperature measurement is provided to the circuitry external to the microprocessor *without any substantial alteration or hindrance to the temperature measurement*." Appx252. As before the Board, Thomas's arguments as to claim 6 are nearly identical to those he advanced

with regard to claim 4. Br. at 31-35. For the same reasons discussed above with regard to claim 4, Thomas's arguments that the Board improperly relied on an incorrect understanding of a "temperature measurement" are unavailing. Moreover, Thomas fails to explain how the prior art analog-to-digital signal is "substantially altered" or "hindered" upon its output from the internal temperature sensor (and thus outside the claim limitation) when this is exactly what Thomas's own application does. Appx34 (¶ [00047]) ("The temperature signal is the digital output of the temperature sensor 4. The temperature signal is '0' while the chip temperature is not 'hot'. However, when the chip temperature becomes 'hot', the temperature signal becomes '1.'"); Appx49 (Fig. 6).

Also, Thomas entirely fails to address the Board and the Examiner's additional reliance on Ikedea's teaching of a "temperature indicative signal representative" of the temperature measurement sent directly to external circuitry to meet this limitation. *See* Appx 6; Appx14; Appx216-217; Appx285-286.

2. **Dependent Claims 7 and 19**

Substantial evidence supports the Board's finding that claims 7 and 19 [9] would have been obvious over the combination of Pippin, Ikedea, and Swamy. Appx8; Appx286-289. While claims 4 and 6 relate to controlling the fan based on the microprocessor's operational mode, claims 7 and 19 further recite controlling the clock based on the microprocessor's operational mode. As the Examiner and the Board correctly found, Ikedea teaches the claimed "determining," "retrieving," "comparing," and "controlling" steps relating to clock control based on the operational mode of the system and control of clock speed based on processor temperature. *See* Appx8; Appx219; Appx287; Appx289. As explained by the Examiner, Ikedea's system operates in "high speed mode" when the temperature of the microprocessor is below the threshold, Appx287, and in "low speed mode" in response to the temperature of the microprocessor exceeding a threshold temperature. Appx286-287 (citing Appx383-385 (col.4, l.58—col.5, l.7); (col.6, ll.8-19); (col.8, ll.33-58)). Furthermore, the Board also agreed with the Examiner's

[9] Claims 7 and 19, which depend from claims 6 and 4 respectively, further recite the use of "operational mode" dependent clock control data that is used to control the "speed" of the microprocessor based on the clock speed data (claim 7) or control "performance" of the microprocessor based on at least the clock speed data (claim 19). Appx252, Appx254-255. Thomas's brief fails to present any separate arguments for patentability with regard to claim 19 and specifically states that claim 7 is "instructive." Br. at 36. Accordingly, the Director will treat claim 7 as representative of claims 7 and 19.

findings that Ikedea's disclosure of switching between high and low clock speed modes "based on the temperature of the microprocessor, correspond to the normal mode and power saving mode of the microprocessor, respectively." Appx8 (citing Appx286-288). Thus, because Ikedea's "operational mode" is a function of the clock speed itself, Ikedea plainly takes into account the "operational mode" of the microprocessor when determining how to control the clock speed.

CONCLUSION

For the foregoing reasons, the Board's decision should be affirmed.

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June 1, 2017

CERTIFICATE OF SERVICE

I hereby certify that, on June 1, 2017, I electronically filed the foregoing BRIEF FOR DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE using the Court's CM/ECF filing system. Counsel for Appellant was electronically served through the Court's CM/ECF filing system per Fed. R. App. P. 25 and Fed. Cir. R. 25(a) and 25(b).

/s/ Farheena Y. Rasheed

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CERTIFICATE OF COMPLIANCE

I certify pursuant to Fed. R. App. Proc. 32(a)(7) that the foregoing BRIEF FOR DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE complies with the type-volume limitation required by the Court's rule. The total number of words in the foregoing brief, excluding table of contents and table of authorities, is 9,460 words as calculated using the Microsoft Word® software program.

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